October 13, 1994

Mr. William Reidy
Fine Organics Corporation
205 Main Street
Lodi, New Jersey 07644

**Re: TECHNICAL AND COST ANALYSIS FOR REMEDIAL ACTIVITIES
HEXCEL CORPORATION SITE - ECRA CASE NO. 56009
LODI BOROUGH, BERGEN COUNTY, NEW JERSEY**

Dear Mr. Reidy,

In response to your request, MATRIX Environmental Management, Inc. has reviewed the documentation provided by your office and is pleased to submit the results of our technical and cost analysis.

Our analysis was based upon the information available to us at this time including correspondence from the NJDEP, cost estimate prepared by GEO Engineering (GEO) dated May 5, 1994, correspondence from Fine Organics dated July 13, 1994 and our experience in development of remedial investigation programs and remediation of LNAPL / DNAPL sites.

It is our opinion that the $4.3 million budget outlined in the May 5, 1994 letter from GEO may not be sufficient to address all of the issues raised by the NJDEP. Additionally, we believe that the technical issues involved with DNAPL delineation, recovery, remediation/containment, and monitoring may have been underestimated resulting in an undervalued level of effort and accompanying cost. We base our opinion on the following:

1. Technical issues associated with the investigation and remediation of DNAPL sites are extremely complex. The presence of clay layers, silty deposits, and a fractured basaltic bedrock at the site provides a complex environment for halogenated organic DNAPL migration that cannot be predicted by ordinary hydraulic considerations in the subsurface. The level of effort in delineating the extent of contamination in these subsurface media alone could be immense.

2. According to the NJDEP, there are additional areas of concern to be investigated and that these areas of concern could result in substantial remedial efforts and costs. These areas include the migration of DNAPL into bedrock, sediment evaluation at the storm sewer outfall and investigation of DNAPL migration across the Upper Saddle River.

3. The GEO cost estimate also did not address specific tasks that will be required to comply with the NJDEP's letter of September 15, 1994. These tasks, which are outlined in this analysis, will certainly result in substantially increased project costs.

MATRIX
ENVIRONMENTAL
MANAGEMENT
215 Ridgedale Avenue
Florham Park NJ 07932
201-660-0400
201-660-0606 Fax
A Woman Business Enterprise (WBE)

TECHNICAL OVERVIEW AND CONCERNS

According to the information presented to MATRIX, the primary constituents of DNAPL identified at the site included tetrachloroethene, trichloroethene, chlorobenzene, and methylene chloride. These halogenated organic species are characterized by high density, low viscosity, high toxicity, significant interfacial surface tension in an aqueous environment, and significant solubility with respect to drinking water standards.

These characteristics make the halogenated DNAPLs some of the most difficult substances to recover, contain, remediate, or even monitor effectively in the subsurface. Their high density and low viscosity promotes a high degree of mobility. They may migrate as a discrete DNAPL body, as dissolved constituents in groundwater, or as volatiles in soil gas.

As DNAPL they are acted upon by three distinct forces, gravity, capillary pressure, and hydrodynamic viscous force. Each force may demonstrate a different directional component on the DNAPL body. The vectorial resolution of these component forces decides the movement of the immiscible fluid. Gravity promotes the downward migration of DNAPL. The fluid pressure exerted at the base of a DNAPL body due to gravity is proportional to the DNAPL body height, the density difference between DNAPL and water in the saturated zone, and the absolute DNAPL density in the vadose zone.

Capillary pressure resists the migration of nonwetting DNAPL from larger to small openings in water-saturated porous media. This capillary pressure is inversely proportional to pore radius. Therefore, fine-grained formations and discontinuities, such as clay layers and silty deposits, can act as capillary barriers to DNAPL migration. In the presence of this phenomena, alternate routes such as coarse-grained formations, fractures, root holes, wells, and utilities can become preferential conduits for DNAPL migration. These capillary pressure effects can cause lateral spreading of DNAPL with eventual collection and immobilization in low spots. DNAPL trapped in this way becomes a long-term source of groundwater contamination that is very difficult to find and recover.

Hydrodynamic pressure, caused by hydraulic gradient, as a DNAPL migrational force is usually minor compared with gravity and capillary pressures. The effect of this force on DNAPL migration increases with increasing hydraulic gradient, with a decrease in gravitational force due to reduced DNAPL layer thickness and reduced DNAPL density, and with decreasing capillary pressure due to the presence of coarse media, low interfacial tension, and a high contact angle. The relatively low effect that hydraulic forces have upon DNAPL bodies often results in migration that is inconsistent with groundwater flow. In fact, it has been demonstrated that DNAPL can move in a direction opposite to groundwater flow.

According to our review of the stratigraphy and hydrogeology, the site presents a very complex picture. The presence of discontinuous clay layers, silty deposits, and fractured basaltic bedrock provides a complex environment for halogenated organic DNAPL migration that cannot be predicted by ordinary hydraulic considerations in the subsurface. The level of effort in delineating the extent of contamination alone could be immense.

AREAS THAT WILL REQUIRE FURTHER INVESTIGATION

There appear to be three distinct phases of the remedial activities program which have yet to be addressed.

Investigation of DNAPL Migration Across the Saddle River

GEO Engineering has provided a cost estimate of $25,000 for the off-site testing of groundwater on the opposite bank of the Saddle River. The NJDEP is concerned that DNAPL contamination may have migrated under the Saddle River. GEO did not provide estimates for additional investigative and remedial costs if contamination is detected. If off-site contamination is detected and the source determined to be from the Hexcel Corporation site, significant delineation efforts and follow-up remedial activities will be required. The cost for delineation and remediation could conceivably approach and exceed $1 million in a worst case scenario.

Storm Sewer Outfall - PCB Contamination

It appears that the GEO cost estimate did not account for further sediment sampling and analysis of the storm sewer outfall into the Saddle River as requested by the NJDEP. Previous analyses of the sediments indicated elevated levels of PCBs. GEO may not have accounted for additional costs associated with delineation and remediation of this area of concern. The Department has requested further sampling in this area and is concerned about the impact to the aquatic life in the Saddle River. The Department currently uses the USEPA PCB Sediment Quality Criteria which results in stringent PCB cleanup standards. The cost for delineation and remediation could conceivably approach and exceed $500,000 in a worst case scenario.

Investigation of Contamination in Bedrock

GEO Engineering provided a cost estimate of $10,000 to perform a bedrock groundwater investigation in the vicinity of MW-1 and MW-17. We are extremely concerned about the potential for contamination of DNAPL's into bedrock aquifers. DNAPL introduced into a fractured rock system follows a complex pathway dependent upon the distribution of fractures in the original rock matrix. The number density, size and direction of the fractures often cannot be determined due to the heterogeneity of the fractured bedrock system and the lack of economical formation characterization technologies.

Small volumes of DNAPL can penetrate deeply into fractured systems due to the low retention capacity of the fractures and the ability of some DNAPLs to migrate through very small fractures DNAPL then contained within these fractures will dissolve and be transported through the fracture network with groundwater, and will also diffuse into and sorb onto the porous inter-fracture matrix (weathered or mechanically broken rock fragments or clay materials). Residual saturation and adsorbed chemicals both provide long-term sources of groundwater contamination and are extremely difficult to efficiently remediate. If contamination of bedrock is present, the resulting investigation, delineation and remediation could conceivably approach costs on the order of $1 million and take many years in a worst case scenario.

It must be clearly understood that the rate of DNAPL infiltration into the subsurface may be extremely rapid. For example, in laboratory experiments have observed tetrachloroethene to sink through 2 feet of coarse sand (under vadose zone conditions, ie. variably saturated) in 10 minutes and 3 feet of saturated sand in 60 minutes. At this rate of penetration, for example, it might take a DNAPL such as PCE approximately 5 hours to penetrate 60 feet of coarse sand in the vadose zone. The actual penetration time will ultimately depend upon conditions such as soil and bedrock heterogeneity and DNAPL properties such as density and viscosity. Therefore, for a sufficient volume, DNAPL can reach a relatively deep water table in a matter of days to weeks, as opposed to years.

We are very concerned about the impact of DNAPL contamination to bedrock. DNAPL migration to bedrock aquifers could impact the cost of this project in values that could exceed our worst case scenario.

REVIEW OF GEO ENGINEERING COST ESTIMATE DATED MAY 5, 1994

We substantially agree with the costs outlined by GEO for Tasks II through VI. However, we disagree with the estimate provided for Task I - Discharge Permit Issues.

GEO estimates addressing the Discharge Permit Issues - including the finalization of design and submittal of Permit Applications for the Sewer Connection and Stream Encroachment Permits, obtaining approvals required by the Borough of Lodi and the Passaic Valley Sewerage Commissioners (PVSC), obtaining Sewer Connection and Stream Encroachment Permits from the NJDEP, obtaining PVSC Discharge Permit along with the construction and installation of the new sewer line, and engineering oversight for $26,000. This price seems low. MATRIX estimates approximately $100,000 for these tasks.

Further, there is no reference to the management of excess soils that will certainly be generated during the installation of the new sewer line. Depending on the volume generated and the waste classification of these soils, the cost can vary from $10,000 to $50,000.

ADDITIONAL TASKS/ITEMS NOT INCLUDED IN GEO ESTIMATE

In addition the technical issues associated with the investigation and possible remediation of the areas of concern described above, the following tasks were not contained in the GEO cost estimate.

The GEO cost estimate did not include a cost for the installation of a DNAPL barrier. The NJDEP has specifically requested that Hexcel provide a thorough evaluation of the distribution of DNAPL and all areas where DNAPL may potentially be discharging into the Saddle River. The NJDEP will entertain a proposal for various types of barriers to be installed. Eventually, however some type of barrier will be required. Depending upon the type of barrier installed (sheet pile, slurry wall, etc.) the cost for design and installation can be estimated at approximately $200,000.

The GEO cost estimate does not include the cost for a full time licensed treatment plant operator. Assuming that the groundwater treatment system is operating for 5 years this cost can be estimated at:

5 years × $42,000/year = $210,000

As discussed in the Fine Organics letter dated July 13, 1994 and the NJDEP letter dated September 15, 1994, Hexcel cannot further delay groundwater remediation. It is estimated that the necessary endorsements and permits required to install the separate sewer line to discharge treated groundwater could take up to one year. If the treated water is hauled via truck to an off-site disposal facility and assuming the hydraulic control is achieved at 7,200 gallons / day as estimated by Hexcel in the February 24, 1994 letter, the additional costs (which were not outlined in the GEO estimate) would be approximately:

7,200 gallons / day (5 days / week)(52 weeks / year)($1.00 / gallon) = $1,872,000

As discussed in the Fine Organics letter dated July 13, 1994, the PCB- related remediation was not addressed in the GEO cost estimate. The PCB remediation includes decontamination of Building No. 1, decommissioning and demolition of the building, extraction of any contaminated groundwater, and excavating and disposal of PCB contaminated soils. The cost to perform this work is estimated at $500,000. The cost to remove approximately 2644 cubic yards of PCB- contaminated soils under Bldg. 1 has been estimated by other consultants to be approximately $1.586 million.

It is also unclear whether all of the consultant's costs and expenses are included in the estimate. The project management, contractor oversight, QA/QC and reporting requirements are substantial for a project of this nature and can reasonably be expected to be estimated at 15 to 20 percent of the total construction costs. Given the conditions we have described in our worst case scenario, consulting costs on a project of this magnitude can be estimated at $1 million.

In summary, under worst case scenarios the following additional costs could be incurred during the investigation and remediation of this site:

Summary of Costs

1.	Investigation of the opposite bank of the Saddle River	$ 1,000,000
2.	Investigation of PCB contamination at storm sewer outfall	500,000
3.	Investigation and remediation of DNAPLs in bedrock	1,000,000
4.	Permitting cost for Task I	+ 76,000
5.	Management of contaminated soils from sewer line installation	50,000
6.	DNAPL Barrier - engineering design and installation	250,000
7.	Treatment plant operator	210,000
8.	Disposal of contaminated fluids	1,872,000
9.	PCB remediation - Building. No.1	2,100,000
10.	Consulting fees	$ 1,000,000
	Subtotal Additional Tasks	$ 8,058,000
	GEO Engineering Estimate	$ 4,371,000
	Total - Potential Worst Case Estimate	$ 12,429,000

In summary, it is our opinion that GEO Engineering did not account for all of the tasks that will be required by the NJDEP in the performance of the remedial activities program for this site. In addition, certain areas of concern are still in the early investigative phase.

Given the technical difficulties associated with delineating, containing and remediation of DNAPL contamination, it is not inconceivable that the costs outlined by MATRIX would be realized, or exceeded, in a worst case scenario. Of course, better estimates on the remediation costs could be generated upon the completion of the investigative work for the areas that we discussed in this letter.

Do not hesitate to contact us at (201) 660-0400 to discuss this matter further.

Sincerely,
MATRIX Environmental Management, Inc.,

Alan Guarino
Senior Chemical Engineer

Dennis F. Petrocelli, CPG
Project Manager

DFP/mef

copy to: Mr. Michael Naughton